The following is a complete listing of all claims in the application, with an indication of the status of each:

Listing of claims:

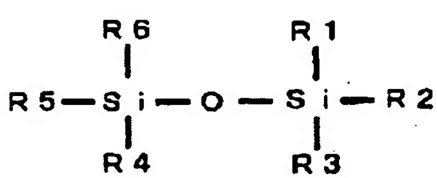
1. (Previously presented) A method of producing a porous insulating film, comprising the step of:

introducing gas containing vapor of cyclic organic silica compounds, which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton, and which is diluted with an inert gas, into plasma to grow a porous insulating film on a semiconductor substrate.

2. (Previously presented) A method of producing a porous insulating film, comprising the step of:

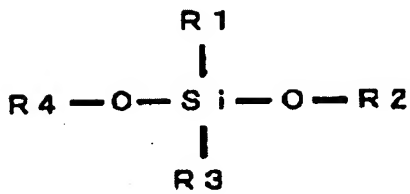
introducing vapor of cyclic organic silica compounds, which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton, and which is diluted with an inert gas, and vapor of straight-chain organic silica compounds, which have silicon and oxygen skeletons and have any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group bound with a side chain of a skeleton, and which is diluted with an inert gas, into plasma to grow a porous insulating film on a semiconductor substrate.

3. (Previously presented) The method of producing a porous insulating film according to claim 2, wherein said straight-chain organic silica compounds have a structure represented by the following formula (1):



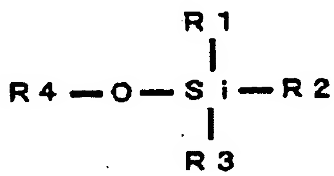
(1)

where R_1 to R_6, which may be the same or different, respectively represent any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group; or



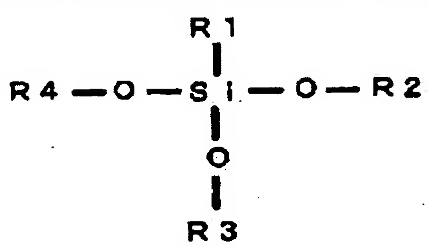
(1)

where R_1 to R_4, which may be the same or different, respectively represent any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group; or



(1)

where R_1 to R_4, which may be the same or different, respectively represent any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group; or

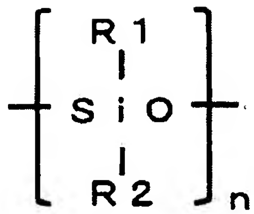


(1)

where R_1 to R_4, which may be the same or different, respectively represent any one selected from the group consisting of hydrogen, a hydrocarbon group and a hydrocarbon oxide group.

4. (Previously presented) The method of producing a porous insulating film according to claim 2, wherein a supply ratio of said cyclic organic silica compounds to said straight-chain organic silica compounds is changed during film formation.

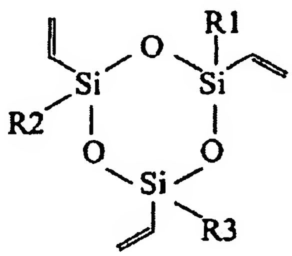
5. (Previously presented) The method of producing a porous insulating film according to claim 1, wherein said cyclic organic silica compounds are cyclosiloxane monomers represented by the following formula (2):



(2) Cyclosiloxane monomer

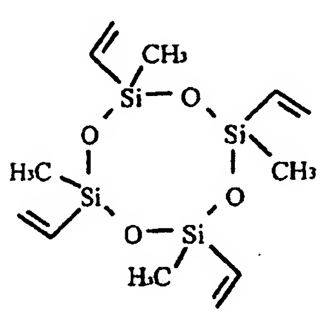
where R_1 and R_2 are respectively any one of the group consisting of hydrogen, an alkyl group, an alkoxide group, an amino group, alkene, alkyne, a phenyl group and a phenol group, provided that R_1 and R_2 may be the same or different, provided that at least one of the side chain groups is an unsaturated hydrocarbon group, and n is an integer of 2 or more.

6. (Previously presented) The method of producing a porous insulating film according to claim 5, wherein said cyclic organic silica compounds are trivinylcyclotrisiloxane derivative monomers represented by the following formula (3):



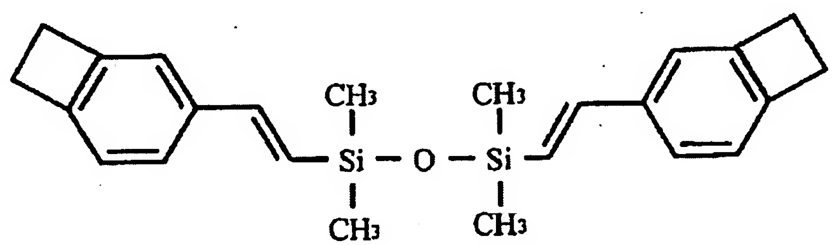
(3) Trivinylcyclotrisiloxane derivative

7. (Previously presented) The method of producing a porous insulating film according to claim 5, wherein said cyclic organic silica compound is tetravinyltetramethylcyclotetrasiloxane monomers represented by the following formula (4),



(4) Tetravinyltetramethylcyclotetrasiloxane.

8. (Previously presented) The method of producing a porous insulating film according to claim 2, wherein said cyclic organic silica compounds are tetravinyltetramethyl-cyclotetrasiloxane monomers represented by the formula (4) and said straight-chain organic silica compounds are divinylsiloxanebenzocyclobutene monomers represented by the following formula (5):



(5) Divinylsiloxanebenzocyclobutene

9. (Previously presented) The method of producing a porous insulating film according to claim 1, wherein said plasma is plasma of rare gas.

10. (Currently amended) ~~A semiconductor device according to~~ The method of claim 1, wherein said plasma is plasma of mixture gas of rare gas and oxidizer gas or hydrogenated silicon gas.

11. (Previously presented) A porous insulating film produced by the method of producing a porous insulating film according to claim 1.

12. (Original) The porous insulating film according to claim 11, comprising at least silicon, carbon, oxygen and hydrogen and having a Raman spectrum corresponding to at least three-membered silica skeleton in the Raman spectroscopic analysis.

13. (Previously presented) The porous insulating film according to claim 11, wherein ratios of elements in the film is: O/Si = 0.8 to 1.2, C/Si = 1.5 to 10.0 and H/Si = 4.0 to 15.0.

14. (Previously presented) The porous insulating film according to claim 11, wherein the diameter of pores contained in the film is 3 nm or less.

15. (Previously presented) The porous insulating film according to claim 11, wherein at least a part of pores contained in the film have almost the same diameters as a skeleton of said cyclic organic silica compounds.

16. (Previously presented) A semiconductor device using the porous insulating film according to claim 11 as a layer insulating film of a multilayer wiring.

17. (Original) The semiconductor device according to claim 16, wherein in the vicinity of a interface between the porous insulating film and a non-porous insulating film, a relative concentration of carbon atom in at least the porous insulating film changes stepwise or continuously.

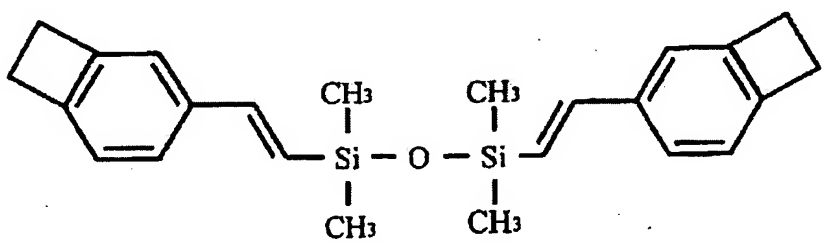
18. (Previously presented) The semiconductor device according to claim 31, wherein said straight-chain organic silica compounds have a structure represented by said formula (1).

19. (Previously presented) The semiconductor device according to claim 16, wherein said cyclic organic silica compounds are cyclosiloxane monomers represented by said formula (2), where R_1 and R_2 are any one selected from the group consisting of hydrogen, an alkyl group, an alkoxide group, an amino group, alkene, alkyne, a phenyl group and a phenol group, provided that R_1 and R_2 may be the same or different, provided that at least one of side chain groups is an unsaturated hydrocarbon group, and n is an integer of 2 or more.

20. (Original) The semiconductor device according to claim 19, wherein said cyclic organic silica compounds are tetravinyltetramethylcyclotetrasiloxane monomers represented by said formula (4).

21. (Original) The semiconductor device according to claim 19, wherein said cyclic organic silica compounds are trivinylcyclotrisiloxane derivative monomers represented by said formula (3).

22. (Previously presented) The semiconductor device according to claim 18, wherein said straight-chain organic silica compounds are divinylsiloxanebenzocyclobutene monomers represented by formula (5):



(5) Divinylsiloxanebenzocyclobutene

23. (Previously presented) A porous insulating film having a distribution of pore diameter with a single peak, wherein the specific inductive capacity is equal to or greater than 2.1 and equal to or smaller than 2.7, and wherein pores within said porous insulating film are enclosed within silica skeletons formed from polymerized cyclic organic silica molecules.

24. (Previously presented) The porous insulating film according to claim 23, wherein a ratio of elements in the film is C/Si = 1.5 to 10.0.

25. (Previously presented) The porous insulating film according to claim 24, wherein a ratio of elements in the film is O/Si = 0.8 to 1.2.

26. (Previously presented) The porous insulating film according to claim 25, wherein a ratio of elements in the film is H/Si = 4.0 to 15.0.

27. (Previously presented) The porous insulating film according to claim 23, wherein a pore diameter at the maximum frequently appearance is equal to or smaller than 1 nm.

28. (Previously presented) The porous insulating film according to claim 23, comprising three membered silica.

29. (Previously presented) A semiconductor device using the porous insulating film according to claim 23 as a layer insulating film.

30. (Previously presented) A porous insulating film produced by the method of producing a porous insulating film according to claim 2.

31. (Previously presented) A semiconductor device using the porous insulating film produced by the method of claim 30.

32-37. (Cancel)

38. (Previously presented) The method of claim 2, wherein said cyclic organic silica compounds have a saturated hydrocarbon group bound with another side chain of said skeleton, and wherein said saturated hydrocarbon group has at least two carbon atoms.

39. (Previously presented) The method of claim 23, wherein said cyclic organic silica molecules have a saturated hydrocarbon group bound with another side chain of said skeleton, and wherein said saturated hydrocarbon group has at least two carbon atoms.

40. (New) The method of claim 1, wherein the introduced gas consists of a vapor of cyclic organic silica compounds and the inert gas.

41. (New) The method of claim 2, wherein the introduced gas consists of a vapor of cyclic organic silica compounds and the inert gas.

42. (New) The semiconductor device of claim 29, further comprising a non-porous insulating film which is in contact with the porous insulating film, wherein a concentration of carbon in the vicinity of the interface between the porous insulating film and the non-porous insulating film changes continuously or stepwise.

43. (New) The semiconductor device of claim 29, further comprising a wiring layer and a via layer, wherein a layer of insulating film of the wiring layer is the porous insulating film, and a carbon concentration of the porous insulating film is higher than the carbon concentration of the layer of insulating film of the via layer.

44. (New) The semiconductor device of claim 29, further comprising a wiring layer and a via layer, wherein a layer of insulating film of the wiring layer or a layer of insulating film of the via layer is the porous insulating film.

45. (New) The semiconductor device of claim 29, further comprising a wiring layer, wherein the porous insulating film is located between a wire of the wiring layer and other wiring of the wiring layer.

46. (New) A method of producing a porous insulating film, comprising the step of:

introducing gas containing vapor of cyclic organic silica compounds which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton, and which is diluted with an inert gas, into plasma to grow a porous insulating film on a semiconductor substrate, wherein said saturated hydrocarbon group has a least two carbon atoms.

47. (New) The method of claim 46, wherein the cyclic organic silica compounds enter into a polymerization reaction by plasma energy and thermal energy from a substrate heating part to

grow said porous insulating film.

48. (New) The method of claim 47, wherein a temperature of the substrate heating part is from 200 to 450 °C.

49. (New) The method of claim 46, wherein a raw material of the cyclic organic silica compounds is heated under reduced pressure to be gasified.

50. (New) The method of claim 47, wherein the polymerization reaction runs under a condition that a power density of plasma formation is from 0.141 W/cm^2 to 0.424 W/cm^2.

51. (New) The method of claim 46, wherein a composition ratio C/Si of the porous insulating film is 2.11 smaller than or equal to a composition ratio C/Si of the cyclic organic silica compounds.

52. (New) The method of claim 46, wherein a composition ratio O/Si of the porous insulating film is 0.12 greater than or equal to a composition ratio O/Si of the cyclic organic silica compounds.

53. (New) The method of claim 46, wherein a composition ratio H/Si of the porous insulating film is 3.90 smaller than or equal to a composition ratio H/Si of the cyclic organic silica compounds.

54. (New) The method of claim 46, further comprising the step of introducing oxidizer gas with the vapor of cyclic organic silica compounds into plasma.

55. (New) The method of claim 54, wherein a flow rate of the oxidizer gas is from 0.3-fold to 1.2-fold of a flow rate of the vapor of cyclic organic silica compounds.

56. (New) The method of claim 54, wherein the flow rate of the oxidizer gas is from 3.38 x 10^{-2} Pa · m^3/s to 1.35 x 10^{-1} Pa · m^3/s.

57. (New) The method of claim 54, wherein the oxidizer gas is selected from N_2O, oxygen, carbon dioxide, an alcohol ROH where R is a hydrocarbon, or phenol PhOH where Ph is a phenyl group, and a mixture of these.

58. (New) The method of claim 57, wherein the alcohol is selected from methyl alcohol, ethyl alcohol, normal propyl alcohol, isopropyl alcohol, normal butyl alcohol and isobutyl alcohol.

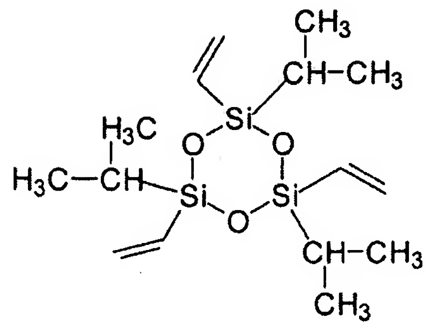
59. (New) The method of claim 46, wherein the saturated hydrocarbon group has at least three carbon atoms and has a branched structure.

60. (New) The method of claim 46, wherein the saturated hydrocarbon group is an ethyl group ($-CH_2CH_3$) or a propyl group ($-CH_2CH_2CH_3$).

61. (New) The method of claim 59, wherein the saturated hydrocarbon group is an isopropyl group ($-CH(CH_3)_2$ or a tertiary butyl group ($-C(CH3)_3$).

62. (New) The method of claim 46, wherein the cyclic organic silica compounds have a six-membered ring structure consisting of three silicon atoms and three oxygen atoms.

63. (New) The method of claim 62, wherein the cyclic organic silica compounds are trivinyltriisopropylcyclotrisiloxane monomers represented by formula (6):



(6).

64. (New) A porous insulating film produced by the method comprising the step of:

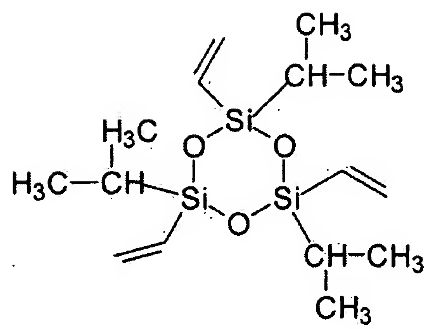
introducing gas containing vapor of cyclic organic silica compounds which have silicon and oxygen skeletons and have at least one unsaturated hydrocarbon group bound with a side chain of a skeleton, and which is diluted with an inert gas, into plasma to grow a porous insulating film on a semiconductor substrate, wherein said saturated hydrocarbon group has a least two carbon atoms.

65. (New) The porous insulating film of claim 64, wherein the cyclic organic silica compounds have a six-membered ring structure consisting of three silicon atoms and three oxygen atoms.

66. (New) The porous insulating film of claim 65, having a spectrum corresponding to at least a three-membered silica skeleton when analyzed by Raman spectroscopy.

67. (New) The porous insulating film produced of claim 65.

wherein the cyclic organic silica compounds are trivinyltriisopropylcyclotrisiloxane monomers represented by formula (6):



(6).

68. (New) The porous insulating film of claim 67, wherein a C/Si composition ratio of the porous insulating film is from 2.89 to 3.33.

69. (New) The porous insulating film of claim 67, wherein a O/Si composition ratio of the porous insulating film is from 1.12 to 1.21.

70. (New) The porous insulating film of claim 67, wherein a H/Si composition ratio of the porous insulating film is from 6.10 to 7.74.

71. (New) The porous insulating film of claim 67, wherein a specific inductive capacity of the porous insulating film is from 2.3 to 2.6.

72. (New) The porous insulating film of claim 64, wherein a diameter of pores in the porous insulating film is smaller than 0.5 nm.

73. (New) The porous insulating film of claim 64, wherein pores in the porous insulating film have the same diameters as skeletons of the cyclic organic silica compounds.

74. (New) A semiconductor device comprising

multilayer wiring with a porous insulating film layer, wherein said porous insulating film layer is produced by a method comprising the step of:

introducing gas containing vapor of cyclic organic silica compounds, which have silicon and oxygen skeletons and have a least one unsaturated hydrocarbon group bound with a side chain of a skeleton, and which is diluted with an inert gas, into plasma to grow a porous insulating film on a semiconductor substrate, wherein said cyclic organic silica compounds have a saturated hydrocarbon group bound with another side chain of said skeleton, and wherein said saturated hydrocarbon group has a least two carbon atoms.

75. (New) The semiconductor device of claim 74, further comprising a non-porous insulating film which is in contact with the porous insulating film, wherein the concentration of carbon in the vicinity of an interface between the porous insulating film and the non-porous insulating film changes continuously or stepwise.

76. (New) The semiconductor device of claim 74, further comprising a wiring layer and a via layer, wherein a layer of insulating film of the wiring layer is the porous insulating film, and the carbon concentration of the porous insulating film is higher than the carbon concentration of the layer insulating film of the via layer.

77. (New) The semiconductor device of claim 74, further comprising a wiring layer and a via layer, wherein at least either of a layer of insulating film of the wiring layer and a layer of insulating film of the via layer is the porous insulating film.

78. (New) The semiconductor device of claim 74, further comprising a wiring layer, wherein the porous insulating film is between a wire of the wiring layer and other wire of the wiring layer.